

AMENDMENTS TO THE CLAIMS

Claim 1. (Currently amended) A charging system for a mobile robot comprising the mobile robot that is battery-driven and moves in a self-controlled way within a work space, and a charging station for accommodating the mobile robot for a battery charging operation, the mobile robot being of the at least four-footed type which ~~quadrupedally~~ walks like a ~~dog~~ animal and has a power connector on the abdomen of a torso unit thereof, the charging system comprising:

a concave receptacle with a power connector on the inner bottom portion of the receptacle; wherein the receptacle supports the mobile robot in a lying down position;

visible recognition data arranged in a predetermined location of the charging station;

image pickup means mounted on the mobile robot;

calculating means for calculating a range and a bearing from the mobile robot to the charging station, based on an image picked up by the image pickup means; and

searching means for causing the mobile robot to search for the charging station, based on the calculation result provided by the calculating means.

Claim 2. (Original) A charging system according to claim 1, further comprising communication means for performing data exchange between the mobile robot and the charging station.

Claim 3. (Original) A charging system according to claim 1, wherein the visible recognition data is a print medium glued onto the surface of the charging station.

Claim 4. (Previously Presented) A charging system according to claim 1, wherein the visible recognition data is formed on a print medium, and a plurality of print media is glued onto the surface of a three-dimensional object.

Claim 5. (Original) A charging system according to claim 1, wherein the visible recognition data is displayed on a screen of a display unit.

Claim 6. (Original) A charging system according to claim 1, wherein the visible recognition data is displayed on a screen of a display unit, and is dynamically used in a manner that prevents the visible recognition data from being merged into the environment of the work space.

Claim 7. (Original) A charging system according to claim 1, wherein the visible recognition data is displayed on a screen of a display unit and is changed in response to a range from the mobile robot.

Claim 8. (Original) A charging system according to claim 1, wherein the visible recognition data is a combination of colors and patterns.

Claim 9. (Original) A charging system according to claim 1, wherein the visible recognition data is a two-dimensional bar code.

Claim 10. (Original) A charging system according to claim 1, wherein the visible recognition data is arranged on an elevated portion of the charging station.

Claim 11. (Previously presented) A charging system according to claim 1, wherein at least one of the charging station and the mobile robot comprises an indicator indicating the condition of a battery.

Claim 12. (Original) A charging system according to claim 1, wherein the charging station further comprises transmitter means that transmits at least one of light ray, infrared ray, sound wave, ultrasonic wave, radio wave, and magnetic field,

the mobile robot comprises receiver means for receiving the wave transmitted from the transmitter means, and

wherein the calculating means calculates the range and the bearing from the mobile robot to the charging station, based on at least one of the image provided by the image pickup means and data received by the receiver means.

Claim 13. (Previously presented) A charging system according to claim 12, wherein the wave transmitted by the transmitter means is easily discriminated and separated from other signals created within the work space.

Claim 14. (Original) A charging system according to claim 1, wherein the mobile robot comprises a head unit which performs a scanning motion with respect to a torso unit, and

at least one of the image pickup means and the receiver means is arranged on the head unit.

Claim 15. (Previously presented) A charging system according to claim 12, wherein the transmitter means transmits at least two signal waves, from among light ray, infrared ray, sound wave, ultrasonic wave, radio wave, and magnetic field, and the receiver means switches the received signal in response to the range between the charging station and the mobile robot.

Claim 16. (Previously presented) A charging system according to claim 12, wherein the transmitter means projects light ray through a slit, and changes the pattern of the slit depending on the direction of light projection.

Claim 17. (Previously presented) A charging system according to claim 12, wherein the transmitter means transmits at least two signal waves that are different in output intensity and frequency component.

Claim 18. (Original) A charging system according to claim 1, wherein the charging station comprises communication means for exchanging data with a device other than the devices of the charging system.

Claim 19. (Previously presented) A charging system according to claim 12, wherein the transmitter means transmits is arranged external to the charging station.

Claim 20. (Cancelled)

Claim 21. (Original) A charging system according to claim 1, wherein the charging station comprises, on the wall thereof, color patterns painted in at least two colors, and the mobile robot searches for the charging station, based on the positional relationship of the color patterns in an image provided by the image pickup means.

Claim 22. (Original) A charging system according to claim 1, wherein the mobile robot is of the four-footed type which quadrupedally walks like a dog, and comprises a power connector on the hip portion of the torso unit thereof, the charging station comprises a receptacle with a bowl-shaped concave, and a generally semi-spherical projection on the generally central position of the bowl-shaped concave, and the receptacle supports the mobile robot in the sitting position thereof.

Claim 23. (Original) A charging system according to claim 1, wherein the mobile robot is of the four-footed type which quadrupedally walks like a dog, and comprises a power connector on the hip portion of the torso unit thereof, the charging station comprises a receptacle with a bowl-shaped, rotationally symmetric concave, and a generally semi-spherical, rotationally symmetric projection on the generally central position of the bowl-shaped concave, and the receptacle supports the mobile robot in the sitting position thereof at any angle.

Claim 24. (Original) A charging system according to claim 1, wherein the mobile robot has a tapered portion on at least one of a head unit, and shoulders and hip portions of a torso unit, and

the charging station comprises a generally U-shaped structure having an inner wall which receives the tapered portion formed on the mobile robot.

Claim 25. (Original) A charging system according to claim 1, wherein the mobile robot has a tapered portion on at least one of a head unit, and shoulders and hip portions of a torso unit, and

the charging station comprises a generally U-shaped structure having an inner wall which receives the tapered portion formed on the mobile robot, and on the deepest inside position of the U-shaped structure, a lip having a connector arranged on the top surface thereof.

Claim 26. (Original) A charging system according to claim 1, wherein the mobile robot has a tapered portion on at least one of a head unit, and shoulders and hip portions of a torso unit, and

the charging station comprises a generally U-shaped structure having an inner wall which receives the tapered portion formed on the mobile robot, and on the deepest inside position of the U-shaped structure, a lip having a connector arranged on the top surface thereof, and each terminal of the connector extends inwardly deeply into the U-shaped structure.

Claim 27. (Original) A charging system according to claim 1, wherein the mobile robot is ambulatory, and an electrode terminal is arranged on the sole of at least one foot.

Claim 28. (Original) A charging system according to claim 1, further comprising at least one electromagnet for generating a magnetic field that connects and disconnects the connector of the mobile robot to and from the connector of the charging station.

Claim 29. (Original) A charging system according to claim 1, wherein the charging station comprises a drive mechanism for placing the mobile robot in an appropriate engagement position therewith.

Claim 30. (Original) A charging system according to claim 1, wherein the charging station comprises a generally U-shaped structure that receives the mobile robot, and grip means for gripping the mobile robot within the U-shaped structure.

Claim 31. (Original) A charging system according to claim 1, wherein the charging station comprises a generally U-shaped structure that receives the mobile robot, and grip means for gripping the mobile robot within the U-shaped structure, and wherein the charging station is used as a carrying case with the mobile robot gripped therewith in.

Claim 32. (Original) A charging system according to claim 1, wherein the mobile robot is of the type that quadrupedally walks like a dog, and the charging station has a kennel-like configuration, and at least one connector is arranged on the inner wall of the charging station.

Claim 33. (Previously presented) A method for searching for a charging station, based on a signal wave transmitted by a transmitter arranged external to the charging station in a charging system comprising a mobile robot that is battery-driven and moves in a self-controlled way within a work space, and the charging station for accommodating the mobile robot for a battery charging operation, the mobile robot being ambulatory and having at least a torso unit and at least two foot units, comprising an electrode terminal for power feeding, on one of the abdomen of the torso unit and the back of the torso unit, the method comprising the steps of:

teaching the position of the charging station based on the signal wave from the transmitter after the mobile robot has been placed on the charging station, and

searching for the charging station by calculating the range and bearing to the charging station, based on the signal wave from the transmitter, with the mobile robot at any position within the work space.

Claim 34. (Previously presented) A method for searching for a charging station, based on a signal wave transmitted by a transmitter arranged external to the charging station in a charging system comprising a mobile robot that is battery-driven and moves in a self-controlled way within a work space, and the charging station for accommodating the mobile robot for a battery charging operation, the mobile robot being ambulatory and having at least a torso unit and at least two foot units, comprising an electrode terminal for power feeding, on one of the abdomen of the torso unit and the back of the torso unit, the method comprising the steps of:

storing beforehand, in a memory of the mobile robot, the position information of the charging station with respect to a reference position set in accordance with the position of the transmitter, and

searching for the charging station by calculating the position of the mobile robot with respect to the reference position, based on the signal wave from the transmitter with the mobile robot at any position within the work space, and reading the position information from the memory to calculate the range and the bearing to the charging station.

Claim 35. (Previously presented) A method for searching for a charging station, based on a signal wave transmitted by a transmitter arranged external to the charging station in a charging system comprising a mobile robot that is battery-driven and moves in a self-controlled way within a work space, and the charging station for accommodating the mobile robot for a battery charging operation, the mobile robot being ambulatory and having at least a torso unit and at least two foot units, comprising an electrode terminal for power feeding, on one of the abdomen of the torso unit and the back of the torso unit, the method comprising:

a calculating step in which the mobile robot calculates the position thereof with respect to a reference position set in accordance with the position of the transmitter, based on the signal wave from the transmitter,

in the calculating step the charging station calculates the position thereof with respect to the reference position, based on the signal wave from the transmitter,

a communication step in which the charging station communicates the position information thereof to the mobile robot, and

a searching step in which the mobile robot searches for the charging station by calculating the range and bearing to the charging station through a relative relationship between the position information.

Claims 36-43. (Cancelled)